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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

EET2166 – INTRODUCTION TO ELECTRICAL POWER AND MACHINES (ME)

27 MAY 2019
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages including cover page with 4 questions only.
2. Answer **ALL** questions. The distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. All necessary working **MUST** be shown.

Question 1

- (a) A 220 V, Y-connected 3-phase generator supplies power to a load consisting of three identical impedances, each having a resistance of $20\ \Omega$ and an inductive reactance of 15Ω , joined in delta connection. Find the:
- (i) Magnitude of phase voltage of the load. [2 marks]
 - (ii) Magnitude of phase current of the load. [3 marks]
 - (iii) Total apparent power delivered to the load. [3 marks]
 - (iv) Total reactive power of the load. [3 marks]
 - (v) Power factor of the system. [3 marks]
- (b) A three phase load composed of three identical impedances connected in star draws a total of 415kVA from a 2400V line. If the load is 0.875 lagging, calculate the:
- (i) Magnitude of load impedance in each phase. [5 marks]
 - (ii) Phase angle between the line to neutral voltage and the line current. [3 marks]
 - (iii) Line current. [3 marks]

Question 2

Figure Q2 shows the exact equivalent circuit of a 50 Hz, 30 kVA, 2200 V/250 V single-phase transformer. Given that $R_p = 0.9\ \Omega$, $X_p = 2\ \Omega$, $R_c = 10\ \text{M}\Omega$, $X_m = 13\ \text{M}\Omega$, $R_s = 0.0094\ \Omega$, $X_s = 0.038\ \Omega$ and iron losses at the rated voltage is 10 kW. A load with 0.8 lagging is connected to the secondary circuit of the transformer.

- (a) Draw the approximate equivalent circuit referred to primary and calculate the equivalent winding resistance and reactance referred to primary. [9 marks]
- (b) Based on the circuit parameters calculated in part (a), determine the full load efficiency. [16 marks]

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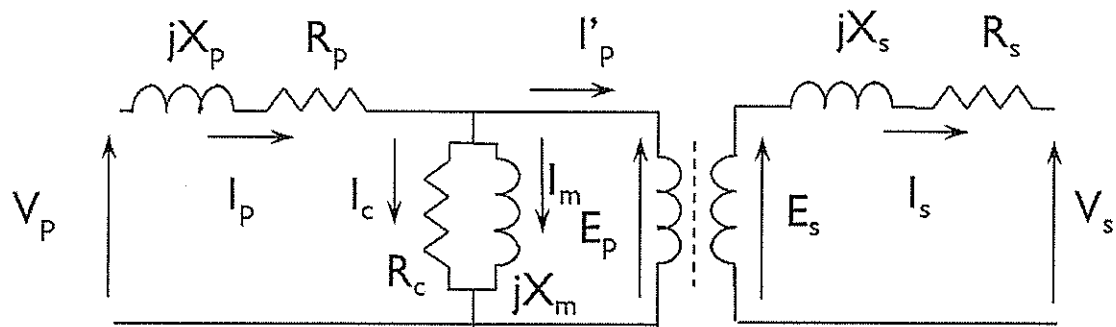


Figure Q2

Question 3

- (a) DC test, no load test and locked rotor test were conducted on a 440 V, 3 phase, 60 Hz, 10 kW, star-connected squirrel cage induction motor. The tests results are listed in Table Q3.

Table Q3

DC test	No load test	Locked rotor test
Measured resistance = 0.5 Ω	V_{NL} (line) = 440 V I_{NL} (line) = 12 A P_{NL} (total) = 1200 W	V_{LR} (line) = 90 V I_{LR} (line) = 50 A P_{LR} (total) = 4200 W

- (i) Determine the stator resistance. [2 marks]
 - (ii) Determine the core resistance and magnetizing reactance. [7 marks]
 - (iii) Determine the rotor resistance and winding equivalent reactance. [9 marks]
 - (iv) Sketch the approximate equivalent circuit of this motor [2 marks]
- (b) A 3 phase, Y-connected, round rotor synchronous generator rated at 230 V has a synchronous reactance of 1.5 Ω per phase and an armature resistance of 0.3 Ω per phase. The generator operates at 0.866 lagging power factor while supplying a line current of 30 A. Calculate the induced phase voltage and the power angle. [10 marks]

Continued ...

Question 4

- (a) Give TWO advantages and TWO disadvantages of setting up a nuclear power plant in Malaysia. Your answer should clearly explain the details.

[8 marks]

- (b) Figure Q4 shows a distribution system protection scheme using IDMT relay. Assume the plug setting current (PS) to be 1 A for both relays 1 and 2. The CB operating time is 0.3 sec. TMS of relay 2 is 0.1. PSM versus the operating time (T) is given in Table Q4.

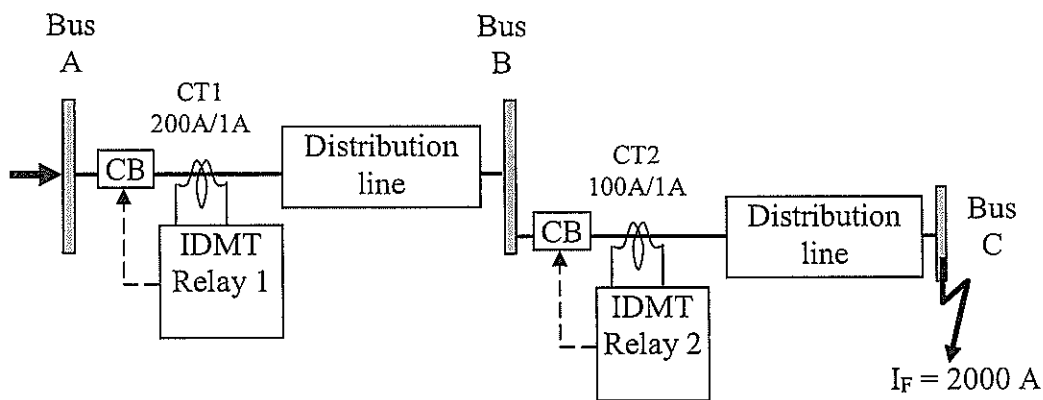
Table Q4

PSM	20	15	10	5
T (sec)	2.2	2.6	3.2	4.3

(Relay operating time = $T \times TMS$)

Determine the TMS and operating time of relay 1 for fault at Bus C.

[12 marks]

**Figure Q4****End of Page**